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TAMARINDUS INDICA SEED: HERBAL ALTERNATIVE TO SYNTHETIC ACID- BASE INDICATOR

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ABSTRACT

Today synthetic indicator is the choice of acid base titrations. But due to environmental pollution availability and cost the search of natural compound as an acid base indicator was started. Indicator is very special chemicals they changes colour of solution with changes in pH by adding acid or alkali. In the present work acid base titration has been performed by using natural indicator aqueous & methanolic extract of seed were used as natural indicator. Two acid (HCL and CH_3COOH) and two base (NaOH and KOH) were selected for titration .0.1N acid and base were prepared. The result obtained by the natural indicator almost similar to synthetic indicator. Thus natural indicator from seed can be used for acid base titration at any dilution. Using aqueous extract from of seed as indicator is more economical and with the same accuracy of result as the given by synthetic indicator.

KEYWORDS: Acid base titration, natural indicator, end point, acid and base.

INTRODUCTION

Indicators are dyes and pigments that can be isolated from a variety of source, including plant, fungi, and algae Almost any Fruit or flower for example that is red, blue, purple , or yellow in colour contains a called of organic pigment called anthocyanin that changes colour with pH . The use of natural dyes as acid base indicators was first reported in 1664 by Sir Robert Boyle in has collection of essay. Experimental history of colour indeed Boyle made an important contribution to the early theory of acid and base by using indicators for the experimental classification of these substances. The idea, however, may actually have originated much earlier- medieval painter used natural dyes treated with vinegar and limewater to make colour change that we see in the nature all around us. We also notice the colour change in ice tea when lemon juice is added. In the study of acid base chemistry, we use litmus paper to indicate if a solution is acidic, base, or neutral based on the colour changes. The substance in plant products such as tea, red cabbage or grapes react "with acid or base" resulting changes at the molecular level which causes their colour to be different at different pH levels.

All pH indictors, such as litmus paper, change colour depending upon whether they donate or accept protons, therefore, pH indicators are themselves acid or base. Indicators work because they are weak acid which, when in solution, exist in equilibrium with their conjugate base. The acids and their conjugate base each have different colours, and as the equilibrium shift from one direction to other, the colour of indicators solution changes. Each indicators must be individually studied to determine behaviour as a function of pH. Acid base titration is determine of the concentration of an acid or base by exactly neutralizing the acid or base with acid or base of known concentration these allows for quantitative analysis of the concentration of unknown acid or base solution. Acid base titrations are used to signal the end of acid base titration. Synthetic indicator have certain disadvantage' like high cost availability and chemical pollution hence indicators obtained from various plant part like flowers, fruits, leaves etc. Will be more advantageous. Economy use of the pigments of some common flower as acid are alkali indicators have been show by using common flower like hibiscus rosasinensis ipomoea fisteolosa and clitoriaturnetea contain various anthocyanin in the form of purple red, violet and blue colours respectively.

Many plant or plant parts contain chemicals from the naturally coloured anthocyanin family of compounds. They are red in acidic solution and blue in basic. Anthocyanin can be extracted with water or other solvents from a multitude of coloured plants or plants part, including from leaves (red cabbage); flowers (gerabnium, poppy or rose petals); berries (blueberries, black berries); and stems (rhuarb) Extracting anthocyanins from household plants, especially red, to form a crude pH indicator is a popular introductory chemistry demonstration.

Litmus, use by alchemists in the middle Ages and still readily available, is a naturally occurring pH indicator made from mixture of lichen species, particularly Roccella tinctoria. The world 'litmus test' has become a widely used metaphor for any test that purports to distinguish authoritatively between alternatives.

PH indicator

A pH indicator is a halochromic chemical compound added in small amounts to a solution so the pH (acidity or basicity) of the solution can be determined visually. Hence, a pH indicator a chemical detector for hydronium ions (H3O+) or hydrogen ions (H+) in the Arrhenius model. Normal, the indicator causes the colour of the solution to change depending on the pH. Indicators can also show change in other physical properties; for example, olfactory indicators show change in their order. The pH value of a neutral solution is 7.0 solution with a pH value below 7.0 are considered acidic and solutions with pH value above 7.0 are basic (alkaline). As most naturally occurring organic compounds are weak protolytes, carboxylic acids and amines pH indicators find indicators find many applications in biology and analytical chemistry. Moreover pH indicator from one of the three main types of indicator compounds used in chemical analysis. For the quantitative analysis of metal cations, the use of complexometric indicator is preferred, where the third compound class, the redox indicators, is used in titrations involving a redox reaction as the basis of the analysis.

Universal indicator

Table 1: Table of Universal indicator.

pH range	Description	Colour
< 3	Strong acid	Red
3-6	Week acid	Orange or yellow
7	Neutral	Green
8-11	Week base	Blue
>11	Strong base	Violet or Indigo

pH indicators are frequently week acids or weak base. The general reaction scheme of a pH indicator can be formulated as:

$$HInd + H_2O = H_3O + Ind$$

Here, HInd stands for the acid from and lnd for the conjugate base of the indicators. The ratio of these determines the colour of the connects the colour to the pH value. pH indicators that are protolytes, the Henderson-Hasselbalch equation for them can be written as:

pH- pka+log10 [Ind] / [HInd]

The equation derived from the acidity constant, states that when pH equals the pKa value of the indicator, both species are present in a 1:1 ratio If pH is above the pKa value, the concentration of the conjugate base is greater than the concentration of The acid and the colour associated with the conjugate base dominates. If pH is below the pKa value, the converse is true. Usually, the colour change is instantaneous at the pKa value, but a pH range exists where a mixture of colour is present. This pH range between indicators, but as a rule of thumb, if falls between the pKa value plus or minus one. This assumes that solution retain their colour as long as at least 10 % of the other species persists. For example, if the concentration of the conjugate base is 10 times greater than the concentration of the acid, their ratio is 10:1, and consequently the pH is pKa +1. Conversely, if a 10- fold excess of the acid occurs with respect to the base, the ratio is 1: 10 and the pH is pHa – 1.

For optimal accuracy, the colour difference between the two species be as clear as possible, and the narrower the pH rang the pH range of the colour changes the better. In some indicator, such as phenolphthalein, one of the species is colours, whereas in other indicators, such as methyl red, both species confer a colour. While pH indicator work efficiently at their designated pH range. They are usually destroyed at the extreme ends of the pH scale due to undesired side reactions.

MATERIAL AND METHOD

Tamarindus indica

Common name: *Tamarind*

Family: Fabaceae

Figure 1: Figure of *tamarind indica.*

Extraction

Seeds of *Tamarindus indica* were collected from satara region. The powder of seeds were dissolved in 30 ml of ethanol and macerated for 24 hours and then extract was filtered. The extract was preserved in tightly closed container and stored away from direct sun light.

Figure 2: Figure of tamarind indica powder and Extract.

Titration

The experimental work was carried out by using the same set of glassware's for all type of titrations. As the same aliquots were used for both titrations the standard indicator, seed extract and the reagents were not calibrated. The equinormal titrations were performed using 10 ml of titrant with few drops of natural indicators.

Figure 3: Titration (Standard).

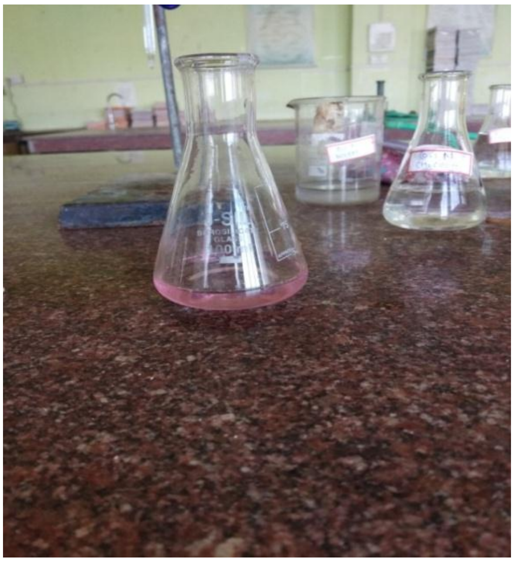

Figure 4: Titration (Extract).

RESULT

The seed extract was screened for its use as an indicator in base and result of this screening was compound with result obtained by standard such as phenolphthalein and methyl Orange indicators for strong acid v/s strong base (HCL and NaOH) strong acid v/s weak base (HCL and KOH) weak acid v/s weak base (CH_3COOH and KOH) strong acid v/s weak base (HCL and KOH) titration. The equivalence point obtained by respective natural indicators with the equivalence point obtained by standard indicators.

Table 2: Table of comparison of color changes.

Sr. no.	Titration	Titrants	Strength	Readings	Colours	After titrant
1	SA vs. SB (**Extract**)	HCL & NaOH	0.1 N	6.1	Faint Yellow	Faint Pink
			0.5 N	7.5		
			1 N	7.4		
	SA vs. SB (Standard)	HCL & NaOH	0.1 N	5.7	Colorless	Pink
			0.5 N	7.2		
			1 N	6.7		
2	SA vs. WB (**Extract**)	HCL & KOH	0.1 N	6.3	Faint Yellow	Faint Pink
			0.5 N	6.5		
			1 N	5.4		
	SA vs. WB (Standard)	HCL & KOH	0.1 N	5.9	Colorless	Pink
			0.5 N	6.6		
			1 N	5.7		
3	WA vs. WB (**Extract**)	CH_3COOH & KOH	0.1 N	10.3	Faint Yellow	Faint Pink
			0.5 N	12.6		
			1 N	9.6		
	WA vs. WB (Standard)	CH_3COOH & KOH	0.1 N	9.1	Colorless	Pink
			0.5 N	11.4		
			1 N	10.6		
4	WA vs. SB (**Extract**)	CH_3COOH & NaOH	0.1 N	10.8	Faint Yellow	Faint Pink
			0.5 N	8.3		
			1 N	10.2		
	WA vs. SB (Standard)	CH_3COOH & NaOH	0.1 N	10.5	Colorless	Pink
			0.5 N	8.3		
			1N	10.4		

SA- Strong acid, SB – Strong Base, WA- Weak acid, WB- Weak Base. VS- Verses

CONCLUSION

The synthetic indicator like phenolphthalein, methyl orange and phenol red are not only hazardous but are also prominent pollutant therefore to solve this problem seed extract has been selected as a source of indicator for a acid base titration. The accuracy of result has been judged by performing a variety of acid base titration. The results were obtained by methanolic extract of *Tamarindus indica*. Thus the use of natural indicator in acid base titration beneficial because of their economy. Easy to prepare easy available, eco-friendly, pollution free, inert, and accurate result.

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